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(56) Documents Cited
GB 1157349 A GB 0664989 A US 4383845 A
US 4337077 A US 3985536 A

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(54) **A plant growth stimulant**

(57) In a process for the producing a plant growth stimulant derived from a mixture of seaweed and peat an aqueous solution of a base e.g. sodium carbonate is prepared, to which is added seaweed and peat. The aqueous mixture of seaweed and peat is heated to a temperature of at least 100°C e.g. to approximately 150°C at 5 bar for approximately four hours, until substantially all of the alginates, nutrients and humates in the seaweed and peat have passed into solution. The aqueous mixture is then cooled, and the aqueous solution containing the extracted alginates, nutrients and humates is separated from the residue. The solution is a 15% concentrate of alginate, nutrients and humates and may be preserved, or alternatively spray dried. The residue is composted.

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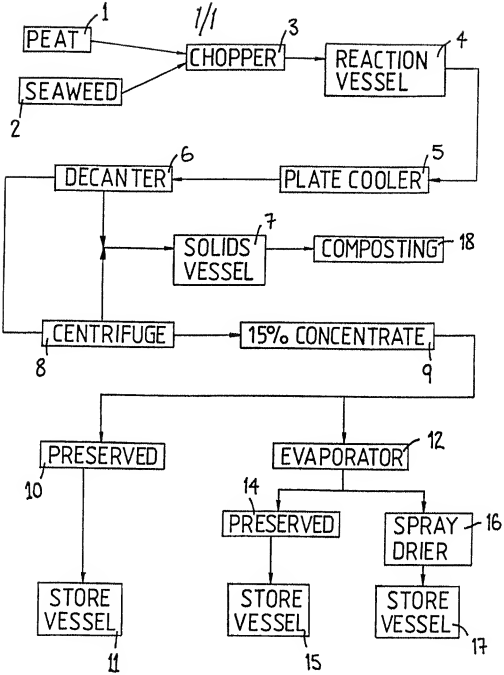
PEAT
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SEAWEED
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REACTION VESSEL
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PLATE COOLER
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18
CENTRIFUGE
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15% CONCENTRATE
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STORE VESSEL
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STORE VESSEL
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SPRAY DRIER
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STORE VESSEL
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"A plant growth stimulant and a process for producing the plant growth stimulant"

The present invention relates to a process for producing a plant growth stimulant, and in particular, for producing a plant growth stimulant derived from seaweed. The invention also relates to a plant growth stimulant when produced from seaweed.

Seaweed is known to be a valuable source of nutrients which are particularly suitable as plant growth stimulants for use in horticulture and agriculture. It is known to extract the nutrients from seaweed by preparing an aqueous solution of seaweed which is heated, generally, under pressure. The aqueous solution containing the extracted nutrients is separated from the seaweed residue, and is used as a plant growth stimulant. Depending on the nutrient concentration of the solution, the solution is diluted with water, and/or mixed with other growth stimulant preparations and fertilizer prior to application to the plants. However, the efficacy of nutrients extracted solely from the seaweed has been found to be limited. Additionally, difficulties arise in filtration of the aqueous solution of seaweed in that in general the aqueous solution contains large numbers of relatively small particles, and it is desirable that they be

filtered out of solution. However, because of the relatively small size of such particles, they tend to lead to blockages of filters. Additionally, the residue filtered from solution, in general, is of little value.

There is therefore a need for a process for producing a plant growth stimulant from seaweed which overcomes problems associated with known processes for production of such a plant growth stimulant, and there is furthermore, a need for a plant growth stimulant which overcomes problems of known stimulants prepared from seaweed.

The present invention is directed for providing such a process and a plant growth stimulant.

According to the invention there is provided a process for producing a plant growth stimulant comprising the steps of heating an aqueous mixture of seaweed, peat and a chemical base to a temperature of at least 100°C until a substantial proportion of alginates, nutrients and humates in the seaweed and peat pass into solution, and separating the aqueous solution containing the extracted alginates, nutrients and humates from the residue to form the plant growth stimulant. Preferably, the aqueous mixture is heated under

pressure.

In one aspect of the invention the aqueous mixture is heated under a pressure of at least 2 bar. Preferably, the aqueous mixture is heated under a pressure of at least 4 bar. Advantageously, the aqueous mixture is heated under a pressure of approximately 5 bar. It is preferable that the aqueous mixture is heated to a temperature of at least 120°C. Preferably, the aqueous mixture is heated to a temperature of at least 140°C. Ideally, the aqueous mixture is heated to a temperature of at least 150°C.

In a preferred aspect of the invention the chemical base is sodium carbonate, and is provided in an amount sufficient for extracting alginates, nutrients and humates from the seaweed and peat. Preferably, the aqueous mixture contains sodium carbonate in an amount in the range of 0.10 to 0.25 parts of sodium carbonate by weight to 1 part dry weight of seaweed and peat. Ideally, the aqueous mixture contains sodium carbonate in an amount of approximately 0.18 parts of sodium carbonate by weight to 1 part dry weight of seaweed and peat.

It is preferable that the proportion of peat to seaweed is in the range of 0.05 to 0.15 parts peat dry weight

to 1 part seaweed dry weight. In a preferred example of the invention the proportion of peat to seaweed is approximately 0.10 parts dry weight of peat to 1 part dry weight of seaweed.

It is preferable that the aqueous mixture of seaweed and peat is agitated during heating, and preferably, the aqueous mixture of seaweed and peat is heated in a sealed reaction vessel.

Preferably, the seaweed and peat are mixed together prior to preparation of the aqueous mixture of seaweed and peat, and advantageously, the seaweed is chopped prior to preparation of the aqueous mixture of seaweed and peat.

The aqueous mixture of seaweed and peat is cooled prior to separation of the aqueous solution containing extracted alginates, nutrients and humates from the residue. Preferably, the aqueous solution containing the extracts is separated from the residue in a horizontal decanter, and advantageously, the aqueous solution containing the extracts is centrifuged.

After cooling and separation, the aqueous solution containing the extracts should contain alginates, nutrients and humates in a concentration of

approximately 15% by weight.

In one aspect of the invention the aqueous solution containing the extracts is subjected to evaporation for increasing the concentration of the alginates, nutrients and humates to at least 25% by weight. In another aspect of the invention the aqueous solution containing the extracts is subjected to evaporation for increasing the concentration of the alginates, nutrients and humates of approximately 30% by weight.

Preferably, a preservative is added to the aqueous solution containing the extracts, and preferably, the preservative is parachlorometacresol.

Alternatively, the aqueous solution containing the extracts is subjected to spray drying for forming a dried powder containing the alginates, nutrients and humates.

In another aspect of the invention the residue from the aqueous mixture is composted.

Additionally, the invention provides a plant growth stimulant comprising alginates, nutrients and humates derived from a mixture of seaweed and peat. Preferably, the alginates, nutrients and humates are

derived from an aqueous mixture of seaweed and peat. Further, the invention provides a plant growth stimulant derived from an aqueous mixture of seaweed and peat, wherein the plant growth stimulant is produced using the process according to the invention.

Further the invention provides a compost prepared from the residue of an aqueous mixture of seaweed and peat wherein the residue is derived from the process according to the invention.

The invention will be more clearly understood from the following description of an embodiment thereof which is given by way of example only, with reference to the accompanying drawing which illustrates a process flow chart of a process according to the invention for producing a plant growth stimulant.

Referring to the drawings a plant growth stimulant is prepared from an aqueous mixture of seaweed and peat. In this example the peat, block 1 in the drawing is of moisture content of approximately 40% by weight, while the seaweed, block 2 in the drawing is freshly harvested seaweed with a moisture content of the order of 75% by weight, approximately. In this case, two seaweeds are used, namely, Ascophyllum modosum and Fucus serratus. It is however envisaged that seaweed

meal or other forms of dried and/or preserved seaweed may be used. Where seaweed meal is used, it is envisaged that the moisture content of the seaweed meal would be in the order of 10% to 12% by weight. The fresh seaweed is initially washed with fresh water to reduce the salt content of the seaweed to approximately 1% by weight of fresh seaweed approximately.

In this example the seaweed and peat are mixed in the ratio of 1 part peat dry weight to 9 parts seaweed dry weight approximately. The mixture of seaweed and peat is delivered into a chopper, block 3 where the mixture is thoroughly chopped and macerated, with the seaweed being chopped to a particle size not greater than 15mm.

An aqueous chemical base solution of water and sodium carbonate is prepared, and an aqueous mixture of the sodium carbonate aqueous chemical base solution and the chopped seaweed and peat is then prepared and placed in a reaction vessel, block 4. In this example the reaction vessel 4 is a jacketed pressure vessel (steam or autoclave). The aqueous chemical base solution contains sodium carbonate in an amount of 0.18 parts approximately sodium carbonate by weight to 1 part seaweed dry weight. The aqueous chemical base solution and the seaweed and peat are mixed in the proportions 0.05 to 0.15 parts approximately dry weight seaweed and

peat to 1 part by weight aqueous chemical base solution. The reaction vessel 4 is sealed and the aqueous mixture of seaweed and peat is heated to a temperature of approximately 150°C at a pressure of 5 bar until a substantial portion of the alginates and nutrients in the seaweed and the humates in the peat have passed into the aqueous solution. It has been found that approximately 95% of the alginates and 97% of the humates pass into solution within approximately two hours. After the aqueous mixture has been heated for four hours approximately, the aqueous mixture of seaweed and peat is cooled to a temperature of 60°C approximately in a plate cooler, block 5. The cooled aqueous mixture is passed into a horizontal decanter, block 6 where the aqueous solution containing the extracted alginates, nutrients and humates is separated from the residue. The residue is collected from the horizontal decanter in a collection vessel, block 7. The separated aqueous solution containing the extracts is centrifuged in a high speed vertical centrifuge, block 8 and any residual solids are collected in the vessel 7. The aqueous solution containing the extracts is collected from the centrifuge 8 in a collection tank 9, and is at a concentration of approximately 15% alginates, nutrients and humates. The 15% concentrated solution may then be preserved by the addition of a suitable preservative, for example,

parachlorometacresol, block 10, and is then stored in a storage vessel 11 for bottling for subsequent sale, or for sale in bulk as the plant growth stimulant. In this example, the preservative parachlorometacresol is added to the 15% concentrated solution in the ratio of 0.003 parts by volume parachlorometacresol to 1 part by volume enriched aqueous solution.

Alternatively, the 15% concentrated solution is delivered to an evaporator 12 where the concentration of alginates, nutrients and humates is increased to 30%. The 30% concentrated solution may be preserved, block 14 in the drawing, to form the plant growth stimulant by the addition of the preservative parachlorometacresol in the ratio of 0.03 parts by volume preservative to 1 part 30% concentrated solution by volume. The preserved solution is then stored in a storage vessel 15. Alternatively, the 30% concentrated solution may be spray dried in a spray drier 16 to form an alginates, nutrients and humates rich powder. The powder is stored in a storage vessel 17 for sale as the plant growth stimulant.

The residue collected in the collection vessel 7 is composted block 18. Such composting processes will be known to those skilled in the art.

Prior to use, where the plant growth stimulant is provided in liquid form, the plant growth stimulant is diluted with water to produce a solution with a concentration of alginates, nutrients and humates in the range of 0.03% to 0.06% by weight for application to plants and crops. The concentration will depend on the plants and crops to which the plant growth stimulant is being applied. It has been found that significantly improved growth rates of the following plants geranium, chrysanthemum, and the like can be achieved by applying a dilute solution of plant growth stimulant of concentration of approximately 0.04% by volume. It has also been found that significantly improved growth rates are achieved by applying a dilute solution of plant growth stimulant with a concentration of approximately 0.03% by volume to the following crops potatoes, sugar beet and the like. In general, it is recommended that the dilute solution of plant growth stimulant should be applied daily to plants and crops.

Where the plant growth stimulant is provided in powder form, the plant growth stimulant is reconstituted by the addition of water and diluted to provide dilute solutions as discussed above.

The compost has been found to be particularly suitable for addition to amenity grass as a top dressing.

The process for preparing the plant growth stimulant according to the invention has many advantages. It has been found that the yield of alginates and nutrients higher than can be achieved in known processes where seaweed is processed on its own. In general, it has been found that yields as high as 1.5 times higher than those which would normally be expected have been achieved. Why these higher yields are being achieved, is not fully understood, however, it is believed that the addition of peat to the seaweed may act as a catalyst for releasing more of the alginates from the seaweed than would otherwise be possible.

Additionally, the aqueous solution containing the extracted alginates, nutrients and humates can be more easily separated from the residue after cooling of the aqueous mixture. It is believed that this is achieved by virtue of the fact that the aqueous mixture contains peat. It is believed that the peat tends to gather up the smaller particles of seaweed residue in solution, thereby increasing the minimum particle size of the residue which, in turn, avoids blockage of filters.

It has been found that the plant growth stimulant produced according to the process of the invention is particularly suitable for use in both horticultural and agricultural applications. It has been found that use

of dilute solutions of the plant growth stimulant on plants and crops, improves the growth rate significantly over and above that which would normally be expected from a dilute plant growth stimulant solution of substantially similar concentration, where the plant growth stimulant was originally derived from seaweed alone. Indeed, it has been found that growth rates of 1.1 to 1.5 times greater than would normally be expected are being achieved by use of dilute solutions of the plant growth stimulant.

In particular, the plant growth stimulant has been found to significantly enhance growth of the following plants:

Rhododendron	Cucumbers
Chrysanthemum	Carnations
Geranium	Radish

The plant growth stimulant has been found to significantly enhance growth of the following crops:

Potatoes	Barley
Wheat	Sugar Beet

The plant growth stimulant when applied to plants and crops in liquid form, is generally sprayed on the plants and/or crops. Alternatively, in certain cases, the plant growth stimulant in powder form may be

distributed over plants and crops by any suitable powder distribution means. Typically, the plant growth stimulant in powder form would be distributed over land prior to rain so that the rain would wash the alginates, nutrients and humates in the powder into the soil.

The reduction of the amount of salt in the seaweed prior to chopping provides a plant growth stimulant which is suitable for use with crops where a relatively low salt content is desirable.

While the aqueous mixture of seaweed and peat has been heated to a temperature of approximately 150°C at a pressure of 5 bar, it is envisaged that good results would be achieved by maintaining the temperature of the heated mixture at a temperature of at least 120°C, at a pressure of 2 bar, approximately. Indeed, adequate results would be achieved by maintaining the temperature of the heated mixture at a temperature of at least 140°C and a pressure of approximately 4 bar during the period while the alignates, nutrients and humates are passing into solution.

It will be appreciated that other means for separating the residue from the aqueous solution containing the extracts may be used besides a horizontal decanter and

vertical centrifuge. It will also be appreciated that other preservatives besides parachlorometacresol may be used for preserving the enriched aqueous solution, and needless to say, the enriched aqueous solution may be provided in concentrates other than those described.

It is also envisaged that other chemical bases besides sodium carbonate may be used. Indeed, it is envisaged in certain cases that potassium carbonate may be used, and in certain cases, it is envisaged that a mixture of sodium and potassium and sodium carbonate may be used.

While the process has been described as comprising a mixture of specific seaweeds and peat, many other suitable seaweeds may be used, for example, seaweed selected from any one or more of the following:

Fucus Serratus, Fucus vesiculosous, Laminaria digitata, Laminaria hyperborean

CLAIMS

1. A process for producing a plant growth stimulant comprising the steps of heating an aqueous mixture of seaweed, peat and a chemical base to a temperature of at least 100°C until a substantial proportion of alginates, nutrients and humates in the seaweed and peat pass into solution, and separating the aqueous solution containing the extracted alginates, nutrients and humates from the residue to form the plant growth stimulant.

2. A process as claimed in Claim 1 in which the aqueous mixture is heated under pressure.

3. A process as claimed in Claim 2 in which the aqueous mixture is heated under a pressure of at least 2 bar.

4. A process as claimed in Claim 3 in which the aqueous mixture is heated under a pressure of at least 4 bar.

5. A process as claimed in Claim 4 in which the aqueous mixture is heated under a pressure of approximately 5 bar.

6. A process as claimed in any preceding claim in

which the aqueous mixture is heated to a temperature of at least 120°C.

7. A process as claimed in Claim 6 in which the aqueous mixture is heated to a temperature of at least 140°C.

8. A process as claimed in Claim 7 in which the aqueous mixture is heated to a temperature of at least 150°C.

9. A process as claimed in any preceding claim in which the chemical base is sodium carbonate, and is provided in an amount sufficient for extracting alginates, nutrients and humates from the seaweed and peat.

10. A process as claimed in Claim 9 in which the aqueous mixture contains sodium carbonate in an amount in the range of 0.10 to 0.25 parts of sodium carbonate by weight to 1 part dry weight of seaweed and peat.

11. A process as claimed in Claim 10 in which the aqueous mixture contains sodium carbonate in an amount of approximately 0.18 parts of sodium carbonate by weight to 1 part dry weight of seaweed and peat.

12. A process as claimed in any preceding claim in which the proportion of peat to seaweed is in the range of 0.05 to 0.15 parts peat dry weight to 1 part dry weight of seaweed.

13. A process as claimed in any preceding claim in which the proportion of peat to seaweed is approximately 0.10 parts dry weight of peat to 1 part dry weight of seaweed.

14. A process as claimed in any preceding claim in which the aqueous mixture of seaweed and peat is agitated during heating.

15. A process as claimed in any preceding claim in which the aqueous mixture of seaweed and peat is heated in a sealed reaction vessel.

16. A process as claimed in any preceding claim in which the seaweed and peat are mixed together prior to preparation of the aqueous mixture of seaweed and peat.

17. A process as claimed in any preceding claim in which the seaweed is chopped prior to preparation of the aqueous mixture of seaweed and peat.

18. A process as claimed in any preceding claim in

which the aqueous mixture of seaweed and peat is cooled prior to separation of the aqueous solution containing extracted alginates, nutrients and humates from the residue.

19. A process as claimed in any preceding claim in which the aqueous solution containing the extracts is separated from the residue in a horizontal decanter.

20. A process as claimed in any preceding claim in which the aqueous solution containing the extracts is centrifuged.

21. A process as claimed in any preceding claim in which the aqueous solution containing the extracts contains alginates, nutrients and humates in a concentration of approximately 15% by weight.

22. A process as claimed in any preceding claim in which the aqueous solution containing the extracts is subjected to evaporation for increasing the concentration of the alginates, nutrients and humates to at least 25% by weight.

23. A process as claimed in any preceding claim in which the aqueous solution containing the extracts is subjected to evaporation for increasing the

concentration of the alginates, nutrients and humates of approximately 30% by weight.

24. A process as claimed in any preceding claim in which a preservative is added to the aqueous solution containing the extracts.

25. A process as claimed in Claim 24 in which the preservative is parachlorometacresol.

26. A process as claimed in any preceding claim in which the aqueous solution containing the extracts is subjected to spray drying for forming a dried powder containing the alginates, nutrients and humates.

27. A process as claimed in any preceding claim in which the residue from the aqueous mixture is composted.

28. A process for producing a plant growth stimulant, the process being substantially as described herein with reference to and as illustrated in the accompanying drawing.

29. A plant growth stimulant comprising alginates, nutrients and humates derived from a mixture of seaweed and peat.

30. A plant growth stimulant as claimed in Claim 29 in which the alginates, nutrients and humates are derived from an aqueous mixture of seaweed and peat.

31. A plant growth stimulant derived from an aqueous mixture of seaweed and peat, wherein the plant growth stimulant is produced using the process of any of Claims 1 to 28.

32. A plant growth stimulant substantially as described herein with reference to the accompanying drawing.

33. A compost prepared from the residue of an aqueous mixture of seaweed and peat wherein the residue is derived from the process of any of Claims 1 to 28.

34. A compost substantially as described herein with reference to and as illustrated in the accompanying drawing.

2.1

The Patent Office

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Claims searched:	1 to 34	**Date of search:**	15 August 1995

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.N): C1B BAB BAD BBK

Int Cl (Ed.6): C05F 11/00, 11/02

Other: ONLINE:PATENTS, AGRI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 1157349 A	MOXHAM see whole document	29,30
A	GB 0664989 A	PLANT PRODUCTIVITY LIMITED	
X	US 4383845 A	RUTHERFORD see the claims, column 3, lines 21 to 65, and column 5, line 46 to column 6, line 26	29,30
X	US 4337077 A	RUTHERFORD see column 5, line 38 to column 8, line 53	29,30
A	US 3985536 A	ABBE	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.